

Mathematical Literacy of Vocational School Students in North Kalimantan

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ABSTRACT

This study aims to describe the mathematical literacy skills of the food crops and horticulture agribusiness students at Bulungan Regency. This case study research focuses on mathematical literacy with the key informants are 5 students of the Agribusiness expertise program who are currently studying at the school. Through interviews, observation, and documentation analysis, it was found that the subject studied mathematics in a context according to the competence of his expertise, which was related to horticultural plants. The mathematics competencies studied refer to the basic competencies in accordance with the vocational high school curriculum structure. Delivering mathematical problems in the form of word problems using the context of horticultural plants is easier for the subject to understand than using other contexts.

Keywords: *Mathematical literacy, word problems, vocational students*

1. INTRODUCTION

Mathematics becomes a subject at every level of education. This means that mathematics was introduced from early childhood and is still being studied at the higher education level. For vocational high schools, mathematics is one of the national content with the highest number of hours of instruction compared to other content [1]. This indicates that student competence related to mathematics is needed in vocational high schools.

To teach mathematics at every level of education, a context is needed, especially for vocational middle school students. The context in learning mathematics is needed to make mathematics learning more meaningful. In addition to the learning process, context is also needed in assessing mathematics learning, especially when measuring students' mathematical literacy skills. There are a variety of contexts that can be applied in mathematics learning. There are at least 4 (four) contexts that can be used in mathematics learning, including personal, educational, individual, and scientific contexts [2].

The concept of mathematical literacy is very close to several concepts discussed in mathematics education, where the most important is mathematical modelling [3]. This indicates that it is possible to train and measure mathematical literacy skills in mathematics learning. In an effort to practice and assess mathematical literacy skills independently, it is important to know the framework used to measure mathematical literacy skills.

PISA's framework for mathematical literacy is organized into three main components, namely situation, content, and competence. The situation and context in which the problem is placed and used as a source of material stimulus. Mathematical content to distinguish problems and question relations, and arranged in terms of ideas. Meanwhile, mathematical competence must be activated and relate to real problems with mathematics, and then used to solve problems [4]. The three main components are used as guidelines in the preparation of mathematical problems.

Each component can be broken down into several small parts. Situations and contexts can be divided into personal, educational, public, and scientific. Content includes changes and relationships, space and form,

quantity, uncertainty and data. While reproduction, connection, reflection are part of competence.

Money questions given to measure mathematical literacy are mostly presented in the form of real-world situations. The use of real-world situations is the condition in which mathematical problems are placed, whereas context is the special setting of the situation. Context can be directly related to the personal activities of students in daily life. In carrying out their activities, each student faces their own challenges and problems that need them as quickly as possible. In this connection, mastery of mathematical knowledge is expected to help solve the problem.

In addition, context can also relate to education, public, and scientific. This educational context relates to student activities in school related to education or the learning process. Mastery of mathematical knowledge is expected to be applied in solving problems and tasks related to their work as students. Meanwhile, the public context is broader than the previous two contexts. The use of the context of the life of the general public and the environment requires the ability of students to be able to apply mathematical knowledge obtained formally or through daily experiences to solve problems in a relevant environment. The last context is a scientific context. This context is more closely related to the abstract scientific method. Problems that use this context require a deeper understanding and mastery of the material in order to solve the problems presented.

In addition to context, in measuring students' mathematical literacy skills, content and competence are needed. There are at least four areas known as overarching ideas, namely change and relationship, space and form, quantity of uncertainty and data. The four contents have been included in the standard content of mathematics learning in vocational high schools. Furthermore, the selection of contexts for relevant content in mathematics learning is expected to optimize the competency possessed by vocational high school students after graduation. In relation to mathematical literacy, there are at least 3 (three) competencies that students are expected to have. The first competency relates to the ability of students to show that they recognize facts, objects and properties, equivalents, use routine procedures, standard algorithms, and use technical skills. Second, students to show that they can make a connection between some ideas in mathematics and some integrated information to solve a problem. And the last one is that students recognize and find mathematical ideas from problems that are presented in an unstructured manner. They can use mathematical thinking and use it to solve problems. In doing this, reflection students analyze the situation they face, interpret, and develop their own resolution strategies.

Taking into account these components, it is possible to hone mathematical literacy skills for vocational high

school students. This is due to the diversity of skill competencies in vocational high schools. According to... there is a expertise program in Indonesia. In North Kalimantan, there are at least 28 vocational high schools. In addition, mathematical literacy skills are needed for vocational high school students to hone critical thinking skills, mathematical communication, creative thinking, and collaboration skills. For this reason, research was carried out on the mathematics literacy of vocational high school students for the agribusiness expertise program in Bulungan regency in 2019.

2. METHODS

Qualitative research with this type of case study was conducted in 2019 in two vocational high schools in Bulungan Regency, North Kalimantan. The unit of analysis in this study was vocational high school students who were studying mathematics at their respective schools. The research is more specific on the mathematical literacy of students in the agribusiness expertise program. Data was collected through observation, interviews, documentation analysis, and focus group discussions. The data that has been collected is then analyzed using matchmaking techniques, explanations, and time series [5]. To increase the validity of the research data, method triangulation was carried out, extension of observations, and peer discussions.

3. RESULTS AND DISCUSSION

The focus of this research is the mathematics literacy of vocational high school students of the Agribusiness Expertise Program in Bulungan Regency, North Kalimantan. There are two SMKs in Bulungan Regency that carry out agribusiness expertise programs. As described in the research method, the research subjects were selected by purposive sampling. The students who are the research subjects are eleventh grade students who have an interest in learning mathematics. However, researchers realize that there are many parties who are influential in the mathematics learning process. The party in question is the ministry in publishing content standards and competency standards for graduates, the Provincial Education Office of North Kalimantan (especially the vocational high school development sector), the principal, the deputy principal of the school in the field of curriculum, mathematics teachers, and the students themselves.

Taking into account the foregoing, interviews were conducted with these parties ranging from students to the head of the vocational high school development division of the North Kalimantan provincial education office. Interview with the Head of the vocational high school development division regarding the implementation of learning policies at vocational high schools in North

Kalimantan. Interviews were conducted 3 times, namely on Monday, April 15 2019 at the North Kalimantan provincial education office, the second on September 7, 2019 at the school principal's room, and the third on October 17, 2019 at a hotel in Tarakan City.

In the first interview, information was obtained that vocational high school learning should apply the Transdisciplinary curriculum. The application of the curriculum is basically how the student learning process for normative, adaptive, and productive subjects can run simultaneously by taking certain themes. Every teacher has a role in the ongoing productive class.

Meanwhile, in the second interview, an overview of the results of the Transdisciplinary curriculum trial in North Kalimantan was obtained. The following is an excerpt from an interview with the head of the field of vocational high school development in North Kalimantan Province. *"... For mathematics material that trains certain abilities, for example thinking skills or logic, there is no need to force it into productive subjects, so stay in a separate room for the learning process. However, the problem is that currently most vocational high school teachers are not willing to sit together to design collaborative learning ..."*

The statement of the resource person in the second interview was then followed up in the discussion at the third meeting. At the third meeting, data collection was in the form of a focused discussion group because on the same occasion there was also an English lecturer and one Indonesian Language Education lecturer. On the third occasion, the resource person emphasized the learning paradigm in vocational high schools. How is the collaboration of the three types of subjects (adaptive, normative, and productive) in producing graduates who are skilled, have knowledge, and have good attitudes. More deeply, the speakers explained the differences in learning paradigms that should be carried out in High Schools and Vocational High Schools. So, Vocational High School graduates should not be compared with Senior High School graduates because their visions are different.

On another occasion, researchers met with the principal of two Public Vocational High Schools in Bulungan District. The purpose of the meeting was basically to ask permission to carry out research at the school concerned. The principal then recommended that researchers meet with the vice principal of the curriculum field and the math teacher assigned to teach in the tenth grade, which currently has eleventh grade students.

Some of the findings that the researchers obtained were related to mathematics learning in vocational high schools, including those related to vocational high school mathematics competency standards and the teaching materials they used. From the results of the discussion, it was found that the mathematical competencies expected

to be possessed by graduates of vocational high schools were uniform. On the other hand, there are various kinds of skill programs in vocational high schools. In fact, for two programs of the same expertise in different vocational high schools it may have different focuses on their productive fields.

Furthermore, the results of discussions with mathematics teachers from the two SMKs obtained information that the mathematics books that are used as a guide in the learning process are mathematics books for technology, health and agricultural expertise programs. It means that there are no specific mathematics books for each skill program. For example, a mathematics book for light vehicle engineering expertise program, a computer network engineering mathematics book, a mathematics book on agribusiness for food crops and horticulture, and so on. The same thing was obtained when the observation process was carried out to a bookstore in the city of Tarakan to look for vocational high school mathematics books. It turns out that there are no books specifically on the expertise program.

After discussion with the mathematics teacher, the next stage in the research process was a focus group discussion with students who were selected as research subjects. FGDs for each group of students were held 3 times each.

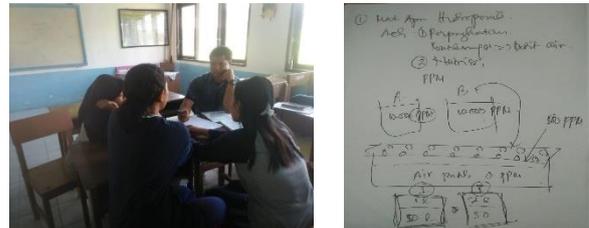


Figure 1 Focus group discussion with vocational high school students

From the FGD process, several research findings were obtained related to the mathematical literacy skills of vocational high school students in the agribusiness expertise program in Bulungan district, including:

- a. Students realize that the competence to solve problems related to the ratio of value and the ratio of turning values can be used to solve problems related to the nutritional needs of vegetables, both on planting media in the form of soil or hydroponic plants.
- b. Students are aware of the competence of number operations in the context of the number of plants that exist. If it is assumed that the number of plants per row or per column or per bed is the same and it is known how many beds there are.
- c. Students realize that the arithmetic series competence or geometric series can be used to find out the total nutrients needed by plants until harvest

can be determined if it is assumed that there is a meaningful pattern related to the addition of plant nutritional needs along with plant age.

- d. Students realize that there are competencies related to statistics that can be used to solve math problems related to the context of determining the number of fish in a fish pond.
- e. Students realize that there are competencies related to statistics that can be used to solve mathematical problems related to the context of determining the level of soil inertia for agriculture.
- f. Students realize that there are competencies related to the optimum (maximum / minimum) value associated with vegetable crop production.
- g. Students realize that measurement competence can be related to the making of beds and spacing of plants.
- h. Students realize that estimating competence (approximation) can be applied in various agribusiness contexts.

The findings above indicate that students who have an interest in mathematics have good mathematical literacy skills. Furthermore, it was found that they trained their mathematical literacy skills by paying close attention to teacher explanations and trying to find relationships with productive subjects. Subjects realized that their interest in mathematics made it easier for them to solve several problems in the agribusiness sector, especially in the practice of productive subjects.

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REFERENCES

- [1] Muhammad, H. (2018). Struktur Kurikulum Sekolah Menengah Kejuruan (SMK) / Madrasah Aliyah Kejuruan (MAK). Jakarta: Kemendikbud.
- [2] Lange, J. D. (2007). Aspects of the Art of Assesment Design. In A. H. Schoelfeld, *Assesing Mathematical Proficiency* (pp. 99-111). Cambridge: Cambridge University Press.
- [3] Stacey, K. (2010). Mathematical and Scientific Literacy Around The World. *Journal of Science and Mathematics Education in Southeast Asia*, 1-16.
- [4] Thompson, S., Hillman, K., & De Bortoli, L. (2013). *A Teacher's Guide to PISA Mathematical Literacy*. Victoria-Australia: ACER Press.
- [5] Yin, R. K. (2014). *Case Study Research: Design and Methods*. California: SAGE.